

1. INTRODUCTION

The Quality sub-manual is a part of the main quality assurance manual of the college. The primary aim of the manual is to ensure quality and achieve uniformity in the following major activities related to the laboratories:

1. Conducting practical classes.
2. Assessment and evaluation of the performance of the students in the laboratories and workshops.
3. Procuring and receiving materials.
4. Erection and commissioning of the new equipment and machines.
5. Maintenance of equipment and machines.
6. Calibration of the instruments.
7. Ensuring health and safety.

This quality sub manual aims to achieve the following objectives:

1. Desired level of quality and effective use of the resources are ensured.
2. The activities performed in the laboratories and workshops will be to the desired level of accuracy.
3. Errors in the activities can be minimized and deviations from the quality policy can be detected and necessary corrective measures can be taken.
4. The experiments conducted and results of the activities can be made reliable to the desired extent.
5. Risks and Hazards can be prevented ensuring Safety of Human being, Equipment and Machineries involved in the various operations.

2. THE LABORATORY STAFF

The college has a policy of keeping qualified, experienced and skilled staff including laboratory technical supporting staff. The qualification, experience and skills of the laboratory staff shall be in compliance with the requirement of the Quality Assurance system envisaged by the Ministry of Manpower.

Minimum number of staff suggested for each laboratory session of not exceeding 15 students is

1 Lecturer + 1 Trainer/ Instructor + 1 Technician

2.1 TEACHING STAFF

One member of teaching staff from the concerned specialization shall be in-charge of overall supervision and control of each laboratory.

Duties and Responsibilities of Lecturer in-charge of the laboratory/workshop

- Preparing manuals for all the equipment in the laboratories describing the experiments that can be performed using the equipment.
- Scheduling and conducting Practical Classes/Examinations
- Assessment and Evaluation of student activities
- Finding out the requirements for the development and informing the HOS
- Helping in internal auditing and inspections.

Table 1

Lecturer in-charge of the laboratories & Workshop

SI No.	Name of the Laboratory	Lecturer in-charge	Qualification
1	Basic Electrical Engg Lab	Mr.S.A.Saleem	M.E
2	Electrical Machines Lab	Mr.Mohammed Sajid Ali	M.E
3	Electrical Workshop	Mr.Mohammed Farooq Khan	M.Tech
4	Electronics Lab	Mr.V.Ilankumaran	M.Tech
5	Telecommunication Lab	Dr.George Vargheese	Ph.D
6	Cable and Fiber Splicing Lab	Dr.P.Marichamy	Ph.D
7	Engg Instrumentation Lab	Ms.Seeja Benjamin	M.Tech
8	Computer Hardware Lab	Dr.Rolando M.Lontok Jr	Ph.D
9	CAD Labs	Computer Center Staff	-
10	Physics/Science Lab	Mr.Thiagarajan	M.Sc

2.2 SUPPORT STAFF

Efficient and smooth functioning of laboratories and workshops requires adequate number of technical support staff backed by necessary specialized qualification and experience.

2.2.a Trainer /Instructor

- Ensuring that health and safety procedures are followed by the students.

- Assisting the lecturer in conducting practical classes and examinations in laboratories and workshops.
- Supervision of the student activities and maintenance of records and log books.
- Making demonstrations, checking and verifying the circuit connections.
- Testing the work models, results and installations done by the students.
- Troubleshooting and fault clearing of circuits and laboratory supply systems.
- Controlling the power sources of different equipment and work tables.
- Assisting in the orientation program for new students.
- Supervising the routine maintenance and repair works in the laboratories and workshops.
- Carrying out any other task assigned by the concerned Head of Department or Staff in charge.

2.2.b Assistant Trainer

- Ensuring that health and safety procedures are followed by the students.
- Assisting the trainer in organizing and conducting the laboratory practical classes / workshop practices and practical examinations.
- Participating in the practical training activities.
- Assisting in making demonstrations, checking and verifying the circuit connections.
- Assisting in testing the work models, results and installations done by the students
- Trouble shooting and fault clearing in circuits and laboratory supply system.
- Supervising the routine maintenance and repair works in the laboratories and workshops.
- Supervising the inventory control of the material and equipments.
- Carrying out any other task assigned by the concerned Head of Department / Section / Staff in charge.

2.2.c Laboratory/ Workshop Technician

- Control of the laboratory stores, keeping and updating inventory records of all the materials and equipment in the laboratories and workshops.

- Issuing instruments, apparatus, materials and components required for the students for the practical classes and receiving them back after using.
- Implementing the equipment maintenance schedule and frequent inspection of the working conditions of the instruments.
- Receiving materials from suppliers, ensuring their quality and compliance with the specifications and making the entries into store records.
- Assisting the trainer in conducting the laboratory practical classes, workshop practices and practical examinations.
- Participating in the practical training activities.
- Assisting in making demonstrations, checking and verifying the circuit connections.
- Assisting in testing the work models, results and installations done by the students
- Troubleshooting and fault clearing in circuits and laboratory supply system.
- Conducting the routine maintenance and repair works in the laboratories and workshops.
- Carrying out any other task assigned by the concerned head of department or staff in charge.

Table 2**Technician/Instructor in-charge of the Laboratories & Workshop**

Sl No.	Name of the Laboratory	Technician in-charge	Qualification
1	Basic Electrical Eng'g Lab	Mr.James B.Diaz	B.S
2	Electrical Machines Lab	Mr.B.Shankar	Dip.Elec
3	Electrical Workshop	Mr.Mohammed Al-Anqoodi	Dip.Elec
4	Electronics Lab	Ms.Mispah	B.E
5	Telecommunication Lab	Mr.Nanthakumar	Dip. E&C
6	Cable and Fiber Splicing Lab		
7	Engineering Instrumentation Lab	Mr.Sammy B.Chua	M.E
8	Computer Hardware Lab	Mr. Gilbert Pajimna	B.E
9	CAD Labs	Mr.Orlando N.Tuazon	B.S
		Mr.Adrian B.Teano	B.S
10	Physics/Science Lab	Mr.Ernesto T.Morales	B.Sc
11	Chemistry Lab	Mr.Mubarak Ali	B.Sc

2.3 INTERNAL QUALITY CONTROL AUDITORS

The activities of quality assurance program implemented in the laboratories and workshops have to be evaluated and checked frequently for its correctness and effectiveness. A committee headed by the College Dean and lecturers from each specialization and an instructor or technician may be constituted for this purpose.

Responsibilities of internal quality control auditors are:

- To ensure the quality of the equipment, machineries and instruments.
- To check the effectiveness of the experiments.
- To verify the accuracy and reliability of the experimental results
- To assess the progress and effectiveness of the course and training programs.
- To suggest or propose necessary corrective actions.
- To monitor and ensure that the quality assurance program is effectively implemented in all the laboratory activities.

Table 3

Internal Quality Control Auditors of the Electrical and Electronics Section Laboratories and Workshops

Name	Job Title	Qualification	Position
Dr. Ahmed Al-Ghassani	Dean, Nizwa College Of Technology	Ph.D	Chairman
Mr.N.K.R.Nair	HoD, Engineering Department	M.Tech	Member
Dr. P.Marichamy	HoS Electrical and Electronics Engg	Ph.D	Member
Mr. V.Ilankumaran	Lecturer	M.Tech	Member
Mr. Fahad Al-Omairi	Technician	Dip. Elec	Member

2.4 STAFF TRAINING

Both teaching as well as technical support staff shall be conversant with all equipment and machines. They shall have adequate knowledge on all experiments and training programs conducted in the laboratory. Necessary training materials related to the laboratory operations, equipment and machineries shall be made available in each laboratory for making the operations and functions easier, efficient and systematic. Necessary training programs shall be arranged for the staff, whenever new equipment or machineries are installed in the laboratories, in association with technical experts of the supplier/manufacturer. The college shall also conduct an intensive orientation program to new staff joining in each laboratory and workshop.

2.5 TRAINING MATERIALS

The training materials shall include the following:-

- Safety Measures and Precautions to be observed in the laboratory
- Operation Manuals and Catalogs of various equipment and machineries.
- Laboratory Manuals containing instructions and procedures of various experiments and activities of the laboratory.
- Assessment and Evaluation schemes.

2.6 ORIENTATION PROGRAM FOR THE NEW STAFF

An orientation program for a minimum period of one week is to be conducted for the newly hired staff before taking charge of any new laboratories so as to get acquainted with the entire operations and functions of the laboratory.

The activities of the orientation program shall include:

- Safety work practices, safety rules and precautions to be observed in the laboratories and workshops.

- Familiarization of the laboratory operations and functions (including the overall laboratory set-up, equipment organization, tests and experiments, storage system, record keeping and updating, indenting methods etc.)
- Study and understanding of operations and maintenance procedures of different equipment and instruments.
- Study and identification of the laboratory supply system, power control points, switches and breakers for emergency operation etc.
- Overall understanding of the academic structure, rules and regulations, examination and students evaluation schemes.

2.7 TIME MANAGEMENT POLICY

The time schedule of the laboratories and workshops is to be arranged in such a way that a maximum and effective utilization of the laboratory facilities can be achieved. The operation of the laboratories shall be properly scheduled for a minimum degree of utilization of 75%. The equipment student ratio shall be within its limiting margin of 1:3 for laboratories and 1:2 for electrical workshop. The student activities and participation in experiments shall be arranged in such a way that each student will get good exposure to the complete practical aspects of the experiment. A user's log book shall be maintained in each laboratory and workshop to record the daily activities of the students. Daily activities of each laboratory shall be counter signed by the concerned lecturer/Instructor (see Appendix A1 for the samples). Such records shall be made available for the internal quality control and auditing activity. Further these records will help in finding the percentage utilization of the laboratories as well as the equipment.

3. LABORATORY TEACHING – LEARNING PROCESS

Laboratories and workshops shall be equipped and organized with the objective of giving intensive practical training to students in synchronization with the principle and laws covered in classrooms. Experiments and workshop practices shall be organized according to the course outcomes with a view point of matching with the

global technological developments and information interchange. List of training programs and experiments conducted shall be displayed in each lab.

3.1 ORIENTATION PROGRAM TO NEW STUDENTS

An intensive and effective orientation program is to be devised in a suitable manner to the new students before they begin the laboratory or workshop classes. The objectives of the orientation program shall contain the following:

- To make them aware of the risks and hazards involved in laboratory works and shop practices.
- To enable them to understand and apply necessary safety rules and precautions.
- To familiarize with the laboratory setup, operational methodology and general procedures involved in the performance of experiments and workshop practices.

3.2 THE ORIENTATION PROGRAM – ACTION PLAN

- Familiarizing and practicing the safety rules and precautions.
- Studying and displaying charts and posters related to Health and Safety
- Understanding and use of safety equipment and dress code to be used in laboratories and workshops.
- Conducting group discussions and presentations.
- Power point shows emphasizing the risks and hazards in electrical works and safe way of preventing them.
- Familiarization and identification of different equipment and supply sources.
- Creating awareness strategies about the dangers involved and precautions needed in handling the different voltage levels and sources.
- Identifying the locations of control points and main switches and breakers for emergency operations.
- Familiarization and practice of making drill to assembly point in the case of emergencies.
- Practicing the safe evacuation process in hazardous situations such as fire, and the use of fire fighting equipment.

4. **HEALTH AND SAFETY**

Safety is the prime requisite in all work places. A safe and healthy working atmosphere is a basic necessity and has to be ensured in all the laboratories without failure. A simple mistake may lead to severe hazards and accidents and may even lead to irrecoverable damage to human lives, equipment and machineries. Strict adherence to safety rules, practices and precautions can facilitate and ensure a safe onsite working environment.

Necessary charts, posters and pictures emphasizing the importance of safety, precautions to be taken, first aid methods etc, shall be displayed in the laboratories and workshops in addition to necessary instructions and training programs.

A sample poster is given below:

Do's

1. **Do** the necessary preliminary preparations for the Experiment
2. **Do** the connections neatly and firmly tightened
3. **Do** only the experiment assigned to you
4. **Do** the experiment carefully following the correct procedure

Don't's

1. **Don't** run or play in laboratory.
2. **Don't** eat, drink or smoke in laboratories.
3. **Don't** keep unwanted materials in the work table.
4. **Don't** touch live conductor or wire with bare hands.
5. **Don't** clutter floor and tables with books, bags or cases

The following safety precautions and guidelines shall be strictly followed in each laboratory:

- Always wear a protective lab coat/overall and safety shoes.
- Locate and identify the positions of main switches, circuit breakers and emergency switches.
- Make sure of the availability and access to first aid kits, fire extinguishers and other safety equipment.

- Identify the emergency exit ways and assembly points to be used in case of fire or similar hazards.

4.2 FIRST AID PREPARATIONS

The following first aid preparations shall be done in advance:

- Provide adequate number of first aid kits in each laboratory at locations which are easily accessible.
- Keep necessary fire extinguishers, sand buckets, and fire blankets in all the laboratories and workshops
- Ensure their compliance and working condition in accordance with the specified standards envisaged.
- Install fire alarm cum detector circuits and ensure their proper working condition periodically.

5. MAINTENANCE AND TESTING

Strict adherence to the routine and preventive maintenance schedule is a must for smooth and reliable operation of all equipment and machineries.

5.1 EQUIPMENT MAINTENANCE SCHEDULE

A proper schedule shall be maintained for the maintenance of each equipment and machinery. Necessary entries shall be made in the schedule on completion of every maintenance work, with the signature of technician and supervisor attending the job.

A sample format of maintenance schedule is shown below:

Eq. No.	Scheduled Date of Maintenance /service	Actual Date of maintenance/service	Signature of Technician	Signature of Supervisor

5.2 MAINTENANCE MANUAL

Maintenance manual shall be made available for each equipment and machinery. The maintenance manual shall contain the following details:-

- A brief description of the equipment / machinery with the explanation of its use and operation.
- Detailed specification of each item
- Constructional details, block diagrams and circuit diagrams of the electrical connection etc.
- Details of preventive maintenance tasks such as lubrication, replacement and cleaning of parts.
- Details of corrective maintenance tasks such as dismantling and replacement of parts and fault diagnosis procedures.

5.3 MAINTENANCE ACTIVITIES

Following are the various maintenance activities to be carried out in electrical laboratories and workshops.

- Routine and periodic checking and inspections.
- Ensuring proper operations of different parts, elements and equipment.
- Cleaning and lubrication of contacts and bearings.
- Corrective actions against loose connections and contacts.
- Calibration at required periodicity and performance tests.

5.4 REPLACEMENT OR REPAIR

Faulty equipment and machineries shall be repaired or replaced on periodic basis depending on the type and nature of the defect. All sorts of repair work shall be carried out only by skilled and authorized service representatives. Equipments which cannot be repaired shall be replaced for reliable and continuous operation of the laboratories.

5.5 CLEANING OF LABORATORIES AND EQUIPMENTS

All laboratory equipment, machines and instruments along with the working premises including tables, boards etc. shall be kept neat and clean from dust and dirt for safeguarding human health and durability of the equipment. Only permissible cleaning materials shall be used for cleaning the equipment.

- Keep all the work tables, equipments and machines, instruments, racks and cabinets from dust, dirt and oil spills.
- Periodic cleaning of the entire laboratory hall shall be carried out without fail.

6. UPGRADES AND IMPROVEMENT

The various activities and operations of the laboratories shall be continuously monitored and studied for evaluating the performance and necessary corrective actions. Suitable proposals and suggestions for upgrade and improvement of facilities may be prepared by taking into consideration the increasing demand and technological growth.

7. LABORATORY RESOURCES AND MATERIALS

Modern equipment, machineries and other facilities are to be made available in the laboratories so that the practical demonstration and experimental verification of laws and theorems, testing and study of performance characteristics of various devices and practicing recent ways of installations can be carried out in accordance with developments and outbreaks in technology.

Detailed list of all the equipment, apparatus, instruments, materials and components etc. shall be prepared and kept in the laboratory / workshop. The list shall contain all relevant information with suitable classifications, sub- titles, coding and other important details.

7.1 STORAGE

A proper and well organized store keeping system has to be followed for each laboratory. Suitable cupboards, shelves, racks, and cabinets shall be used in the store for keeping portable equipment, instruments and materials including consumables.

Locations of the different items shall be properly arranged so that each item can be easily accessed. Technicians in charge of the laboratory stores shall keep the stock register and update the data timely.

7.2 LABELING

All equipment, machineries, instruments and different classes of consumables shall be provided with suitable labels showing the item name, code and specifications for easy identification and analysis. Also the storage shelves, cupboards, racks and cabinets of all materials including consumables are to be properly numbered and labeled to provide an easy access.

7.3 ELECTRONIC PROCUREMENT & INVENTORY CONTROL (EPIC)

EPIC, which provides a reliable and easy inventory data base for material acceptance, registration and store keeping etc, is highly recommended for each laboratory and workshop. This method facilitates use of standard documents and methods for electronic inventory control. By using this method all records related to material acceptance asset registration, equipment tracking and follow up, stock analysis, reports of maintenance activities, etc can be easily entered and tracked if it will be required in the future.

Each inventory item will be given a bar coded label prepared prior to the acceptance with all details and specifications. The same bar code will be provided against each item in the asset register, manual and all other documents related to it. This makes the tracking of any item with the use of a bar code reader and Personal Digital Assistant (PDA). At present this system is not in place. In future this system will be implemented.

7.4 LABORATORY INDENTING

The technician in charge of the laboratory shall see that any portable instruments, tools and consumable items are issued to students or any other users only through proper requests approved by the staff in charge. Requisitions shall be kept in the concerned file to ensure the safe return of all items issued. Items issued for long term use for projects

and fabrication work shall be recorded in the concerned register. Necessary data back up shall be made periodically in the stock register for all addition and deletion of materials including consumables.

7.5 LABORATORY PURCHASES

Purchase of materials required for the laboratories (including equipments, machineries instruments and consumables etc.) shall be made in advance, forecasting the future needs. All requirements prepared in specified laboratory requisition form, approved and counter signed by concerned HODs shall be forwarded to the purchasing section for further processing.

The final purchase order shall be placed after considering the quality of the product, delivery time, Warranties and provisions for after sale servicing and training.

7.6 RECEIVING AND INSTALLATION OF EQUIPMENTS

New equipment and materials being supplied to the laboratories shall be received by technician or storekeeper after verification of specified quality and working condition in presence of the staff in charge and supplier representatives. It must be ensured that all the specifications of the machines supplied are exactly match as per the purchase order.

- All assembly, installation and commissioning works of sophisticated equipments shall be carried out by technical experts authorized by the supplier.
- The newly purchased equipment shall be tested and certified for proper operation in the presence of the supplier's representative.
- Operating manuals, catalogs, test certificates and other documents shall be collected and kept in concerned files.
- Necessary entries shall be made in stock registers and records.

8. LABORATORY STRUCTURE AND AMENITIES

The laboratories shall be suitably designed and structured by taking into account the following key factors:

- Proper ventilation and air conditioning
- Proper lightning
- Main door and emergency exit door

- Store room with shelves and cabinets
- Supervisors' Cabin
- Wash basin
- Drinking Water
- First Aid Kit
- Fire Fighting Equipment
- Non-slippery Floor

9. BUDGET ALLOCATION

The College shall have a policy of upgrading and improving the laboratory equipment and facilities to cope up with changing technologies. Forecasted annual estimates may be prepared for each laboratory and workshop and submitted in advance to concerned authorities for annual budget allocation. This budget shall be sufficient to meet the following:

- Running Expenses (salaries, maintenance and cleaning, electricity water supply etc)
- Purchase of Consumables
- Upgrades and improvement works
- Purchase of new equipment and machines
- Furniture repair & new purchases

10. INSPECTION AND INTERNAL AUDITING

Necessary inspection and auditing activities are to be conducted by the college internal auditing committee to check the daily activities of the laboratory, performance of the staff, material inventory, maintenance and cleaning activities, documentation, recordings etc. Necessary feed back information shall be collected from students as the end-users of the laboratory about the facilities, effectiveness of the training and staff performance.

Periodic inspection and Internal Auditing will help:

- Monitoring and follow up of all the activities in the laboratories
- Optimizing the utility of the laboratory and workshop
- Improving the quality of services

- Formulating an effective time management schedule
- Planning for annual improvement and upgrading policies

11. CONCLUSION

The Quality sub-manual for Electrical and Electronics Laboratories and Workshops has been prepared with the aim of achieving an effective total quality management system (TQM); which when implemented will ensure the credibility and reliability of the training and learning activities in the laboratories. Also effective utilization of the resources, time and space can be achieved. Strict adherence to Health Safety Environment (HSE) rules and regulations will help in maintaining safety and health of end-users and equipment. Proper follow-up and monitoring activities based on the manual will help bring up the laboratories and workshops in all respects to the desired degree of quality performance and higher standards.